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AN INVESTIGATION OF THE IRON ENRICHMENT OF THE INTRACLUSTER MEDIUM AND GALAXY FORMATION EFFICIENCY IN CLUSTERS

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Final Report

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We have completed the research supported by NAG8-800 (166A3940) entitled "Investigation of the Iron Enrichment of the Intracluster Medium and Galaxy Formation Efficiency" covering the dates 1/1/90–12/31/93. Aspects of this work were contributed to several papers and talks. The implications of this work, discussed in detail in the papers are summarized below.

Numerical simulations of early-type galaxies were performed to determine the energy and mass ejected from evolving galaxies. These calculations were compared to iron abundance measurements of clusters and groups of galaxies which showed that toes standard Salpeter initial stellar mass function would not produce sufficient heavy elements to give the observed intracluster medium abundances. Flatter initial mass functions were found to be needed to produce the observed abundances (Ap.J., 380, 39).

This project also contributed to understanding of the Ginga and Einstein observations of A2163. These observations showed that A2163 was a very massive (2.5×10^{15} $M_\odot$) cluster with a very hot $kT = 12.9$ keV) intracluster medium. These observations implied that in the context of Cold Dark Matter universes, the biasing parameter (which characterizes the relative mass distributions of baryonic and dark matter) could not differ significantly from unity. That is, the existence of massive, hot clusters like A2163 required a universe with little biasing (Ap.J., 390, 345).

The analysis of a sample of clusters and groups of galaxies discussed the systematic behavior of baryonic fractions, mass-to-light ratios, total masses as a function of radius in clusters/groups and also as a function of over density (Ap.J., in press). This work showed that the baryonic fraction in clusters was large and that, in the context of standard Big Bank Nucleosynthesis, the mean mass density of the universe, Ω was significantly less than unity. This result provided another argument against Standard Cold Dark Matter models.